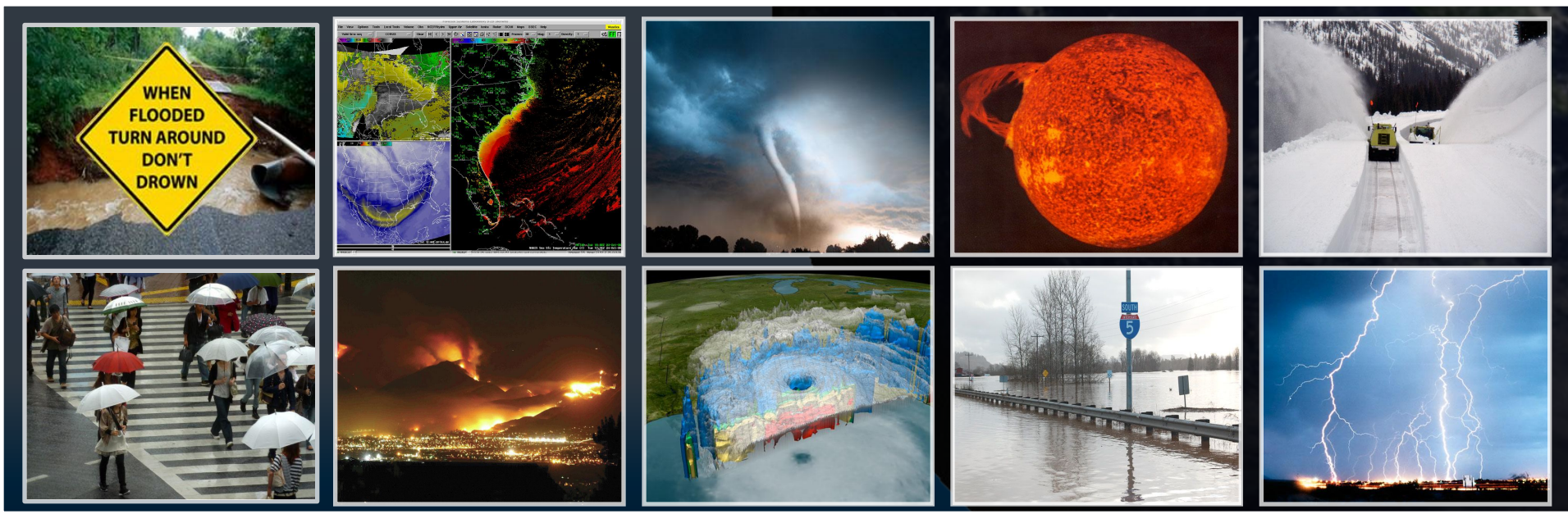
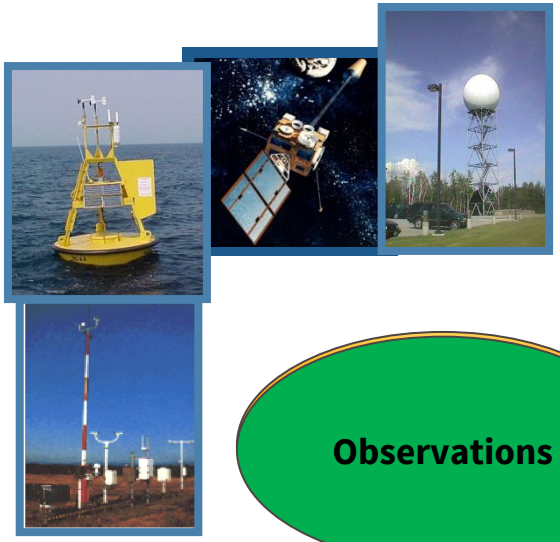
NWS Climate Activities In Observations, Central Processing & Dissemination



NWS National Climate Services
May 10, 2016 · Silver Spring, MD

NWS Forecast Process

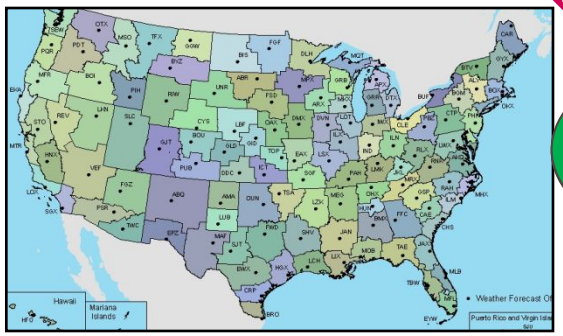


Science & Technology Integration

R2O

O2R

Observations



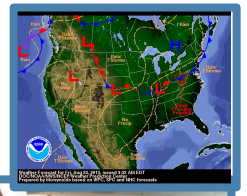
Dissemination

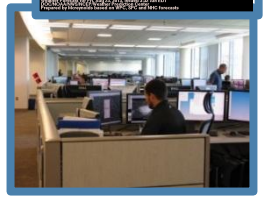
Central Processing

Analyze, Forecast & Support

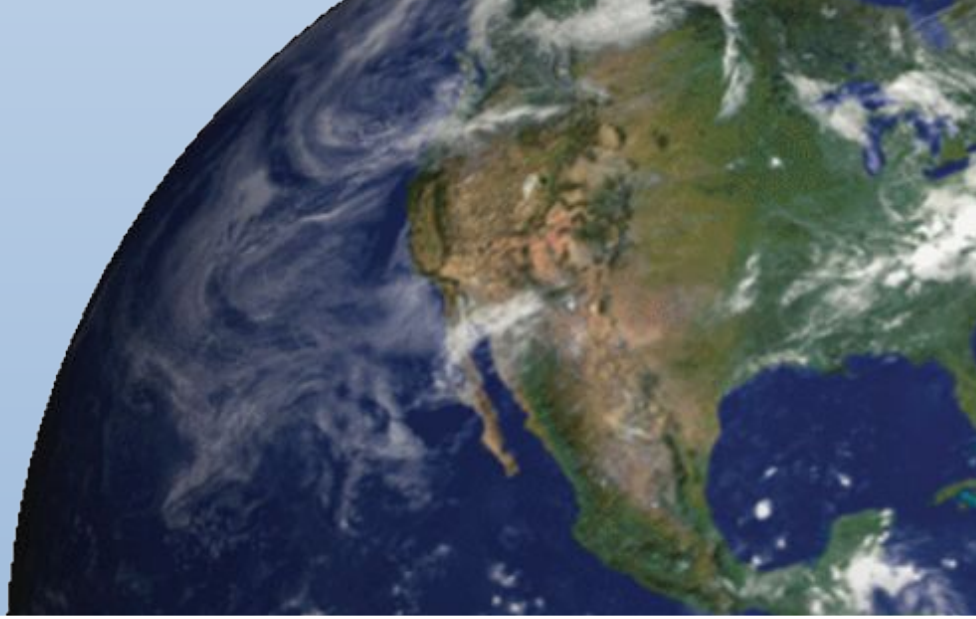
Central Guidance

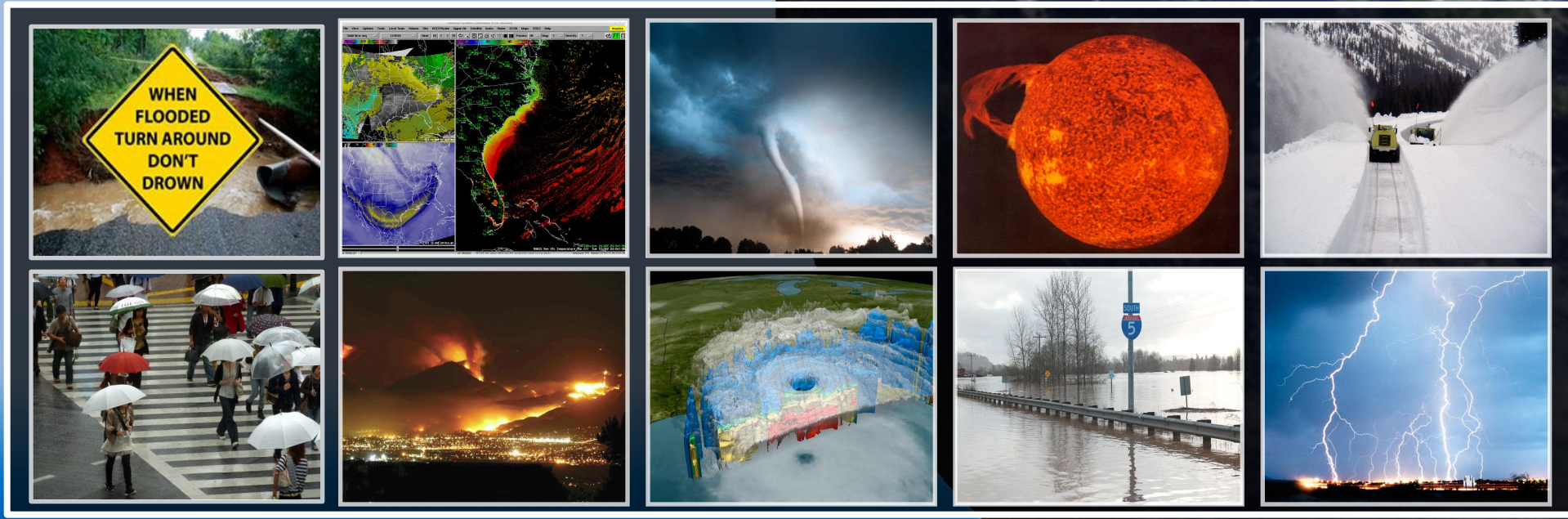
Local Forecasts





NWS Climate Activities in Observations

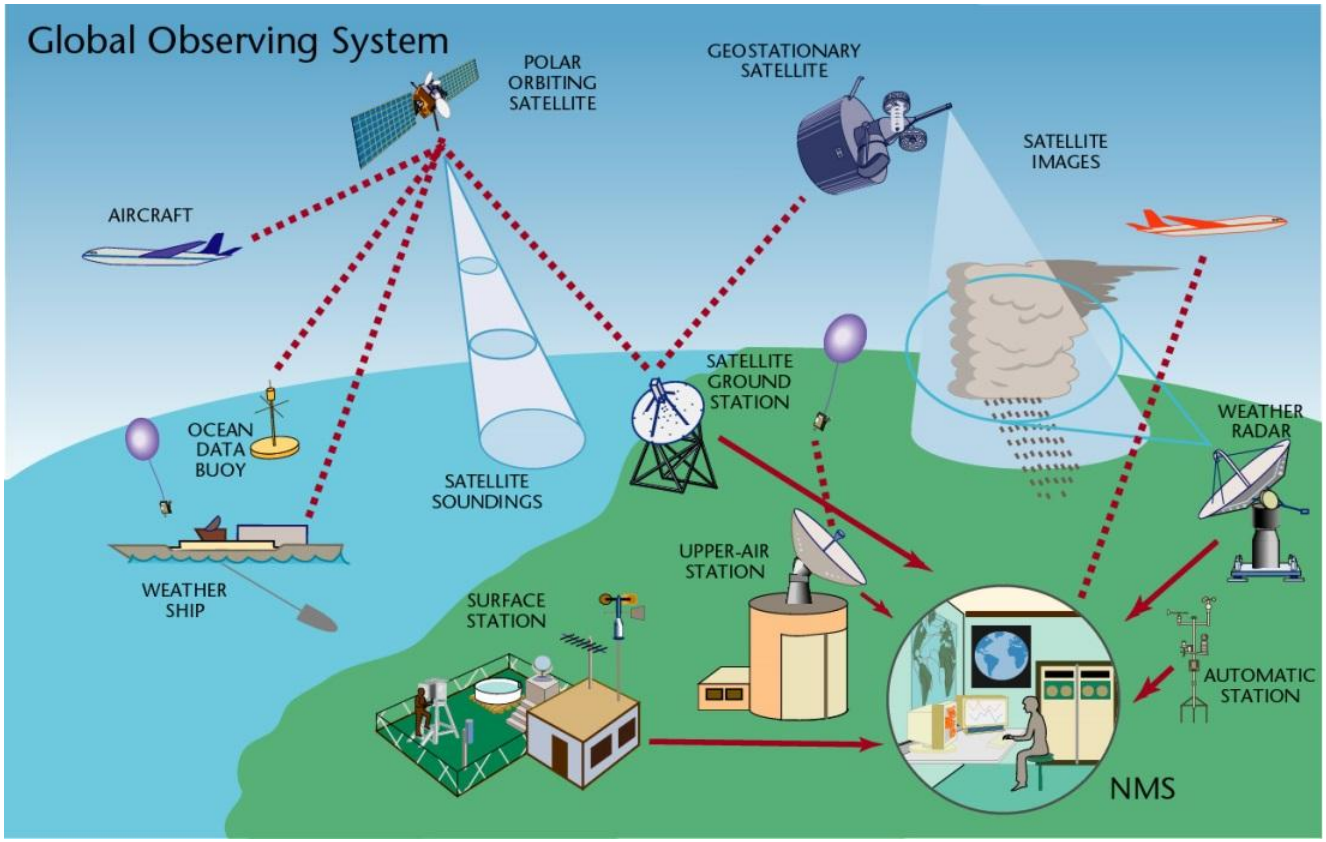




NWS National Climate Services
May 10, 2016 · Silver Spring, MD

Observations Portfolio

Responsible for the collection of space, atmosphere, water, and climate <u>observational data owned or leveraged</u> by the NWS



Sustaining Critical Observations

Maintaining system availability to support the NWS mission -

NEXRAD

- Maintain system availability > 96%

Upper Air

- Maintain 102 sites with GPS radiosondes; 2 launches per day

ASOS

- Maintain system at required sensor availability > 96%

Buoy Networks – Weather, DART, TAO

- Average network data availability > 80%

Investing in Observation Infrastructure

NEXRAD Service Life Extension Program

- Signal Processor Technology Refresh
  - Development & Integration Testing Complete
  - System Testing Underway
  - Deployment Begins in FY
- Transmitter Technology Refresh
  - Work Initiated
- Shelter Refurbishment
- Pedestal Refurbishment

Investing in Observation Infrastructure

Radiosonde Frequency Migration Project

- Due to the sale of “spectrum”, radiosondes operating in the 1680 MHz band must be migrated to operate in the 403 MHz band.
- Funds from the “spectrum” sale are being used to finance the migration.
- “Autosonde” technologies are being evaluated as a potential alternative.

Investing in Observation Infrastructure

Automated Surface Observing System (ASOS)
Acquisition Control Unit / Data Collection Package Redesign

- ACU / DCP components reaching obsolescence in the near future
- 2 ACU and 2 DCP Prototypes Built
- Preparing for System Tests
- Preparing for Drawing Validation and Level III Drawing Package release

Ensuring Readiness for Satellite Observations

DSCOVR

- Launched February 11, 2015

Jason-3

- Launched January 17, 2016

GOES-R

- Launch Date: October 14, 2016

JPSS-1

- Launch Date: Q2 FY17

COSMIC-2a

- Launch Date: Q2 FY17

Observation Systems Impact: Climate Changes and its Impacts

Assessments of Climate Changes and its impacts		
Data Source	% Impact	SQ Score 72.04
Metop-A and -B	10.56%	7.61
POES	8.53%	6.15
DMSP	6.33%	4.56
NOAA Ships	5.38%	3.88
Global Argo Profiling Floats	4.55%	3.28
Global Drifter Program	3.94%	2.84
COOP	3.40%	2.45
SNPP	3.07%	2.21
TAO	2.78%	2.00
GOES	2.66%	1.92
Carbon Tracking Observing System	2.52%	1.82
GOS Regional Basic Surface Synoptic Network	2.14%	1.54
JASON-2,3,CS	1.87%	1.34
University-National Oceanographic Laboratory System	1.85%	1.33
OAR Autonomous Underwater Vehicle	1.82%	1.31
NEXRAD	1.77%	1.27
ASOS/AWOS	1.65%	1.19
Global Ocean Reference Stations	1.65%	1.19
Chartered Vessels Research	1.55%	1.12
Meteosat	1.52%	1.09
VOS	1.48%	1.06
Global Ocean Ship-based Hydrographic Investigations Program	1.41%	1.02
GOS Upper Air Network	1.38%	1.00
Research Moored Array for African-Asian-Australian Monsoon Analysis	1.31%	0.95
NWLON	1.25%	0.90

- Sustain critical NWS observing systems
  - COOP
    - Develop wireless temperature sensor
  - TAO
    - Maintain network availability ≥ at 80%
- Leverage NOAA systems
  - Polar Satellites – JPSS launch Q2FY17
  - NOAA Ships
  - GOES – GOES-R launch Oct 2016
  - Carbon Tracking Observing System
- Leverage non-NOAA systems
  - Metop
  - DMSP
  - Argo Profiling Floats
  - Global Drifter Buoys
  - GOS Regional Basic Surface Synoptic Network

15 of 75 Key Products & Services are produced by NWS

Observation Systems Impact: Climate Prediction & Projections

Climate Prediction and Projections		
Data Source	% Impact	SQ Score 70.16
POES	12.12%	8.51
Global Argo Profiling Floats	9.65%	6.77
Metop-A and -B	8.57%	6.01
NOAA Aircraft	6.58%	4.62
JASON-2,3,CS	6.36%	4.46
TAO	5.13%	3.60
Global Drifter Program	5.07%	3.55
SNPP	4.32%	3.03
RAOB	3.45%	2.42
AMDAR/MDCRS Group	3.12%	2.19
Animal Borne Tagging and Bar Coding System	3.07%	2.16
GOES	3.01%	2.11
AQUA	2.98%	2.09
NEXRAD	2.62%	1.83
NOAA Ships	2.54%	1.78
Research Moored Array for African-Asian-Australian Monsoon Analysis	2.27%	1.59
VOS	2.26%	1.58
Prediction and Research Moored Array in the Atlantic	1.75%	1.23
GOS Upper Air Network	1.67%	1.17
TERRA	1.64%	1.15
Global Ocean Reference Stations	1.60%	1.12
ASOS/AWOS	1.36%	0.96
DMSP	1.36%	0.95
COSMIC	1.33%	0.93
Coriolis WindSat	1.23%	0.86

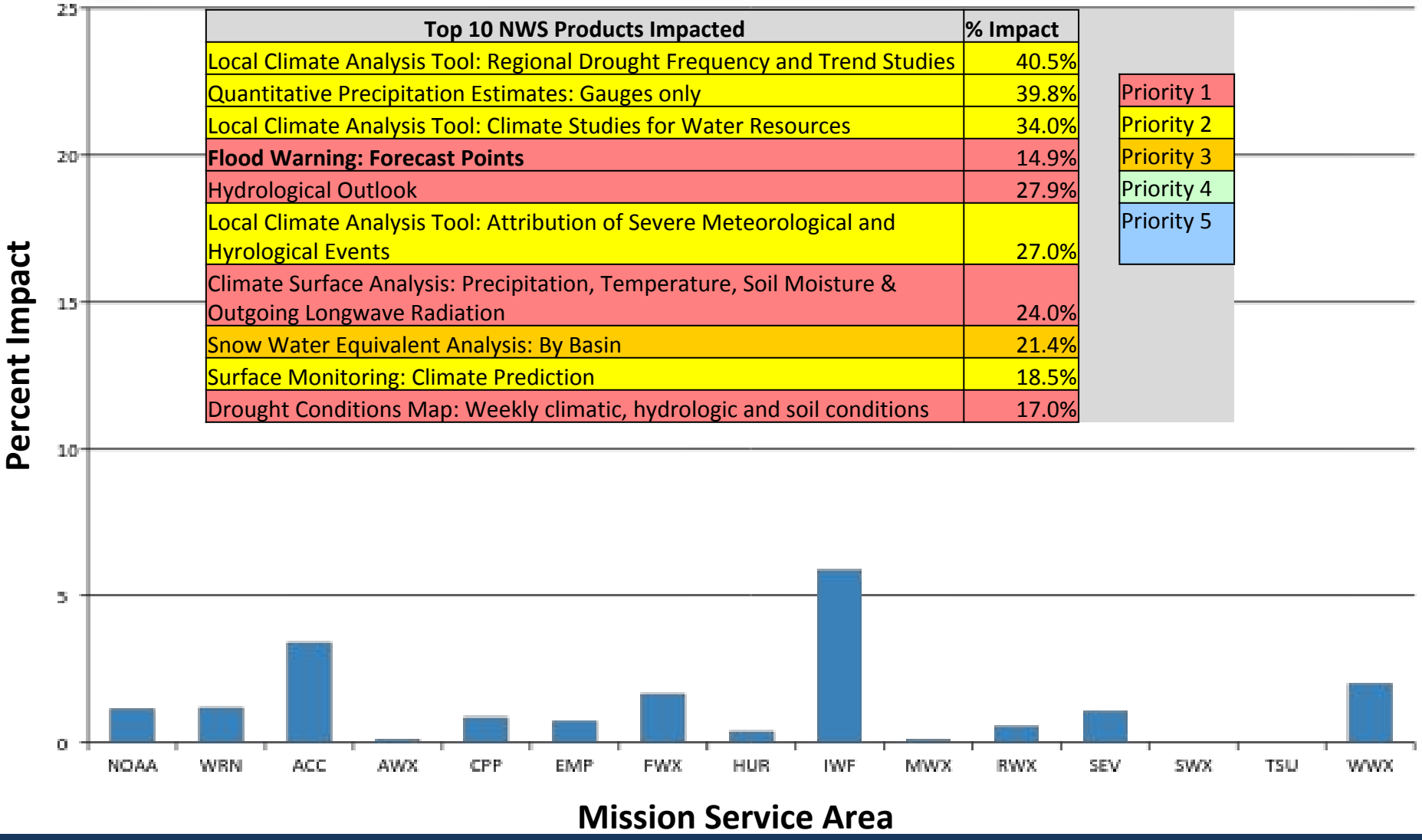
- Sustain critical NWS observing systems
  - TAO
    - Maintain network availability ≥ at 80%
  - RAOBs
    - Radiosonde Frequency Migration
  - NEXRAD
    - Continue SLEP
  - VOS
    - Provide instrumentation for “VOSClim” vessels
- Leverage NOAA systems
  - Polar Satellites – JPSS launch Q2FY17
  - NOAA Aircraft
  - JASON Satellite
  - GOES – GOES-R launch Oct 2016
  - NOAA Ships
  - PIRATA
- Leverage non-NOAA systems
  - Argo Profiling Floats
  - Metop
  - Global Drifter Buoys
  - AMDAR/MDCRS

12 of 18 Key Products & Services are produced by NWS

Percent Impact of COOP on Multiple MSAs

Top 10 NWS Products Impacted	% Impact
Local Climate Analysis Tool: Regional Drought Frequency and Trend Studies	40.5%
Quantitative Precipitation Estimates: Gauges only	39.8%
Local Climate Analysis Tool: Climate Studies for Water Resources	34.0%
Flood Warning: Forecast Points	14.9%
Hydrological Outlook	27.9%
Local Climate Analysis Tool: Attribution of Severe Meteorological and Hyrological Events	27.0%
Climate Surface Analysis: Precipitation, Temperature, Soil Moisture & Outgoing Longwave Radiation	24.0%
Snow Water Equivalent Analysis: By Basin	21.4%
Surface Monitoring: Climate Prediction	18.5%
Drought Conditions Map: Weekly climatic, hydrologic and soil conditions	17.0%

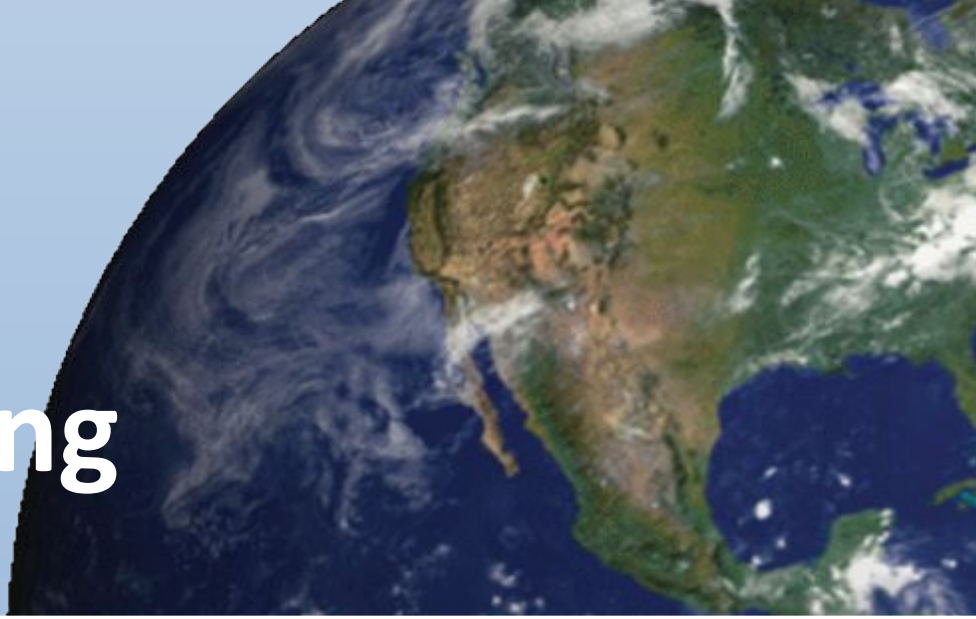
Priority 1
Priority 2
Priority 3
Priority 4
Priority 5

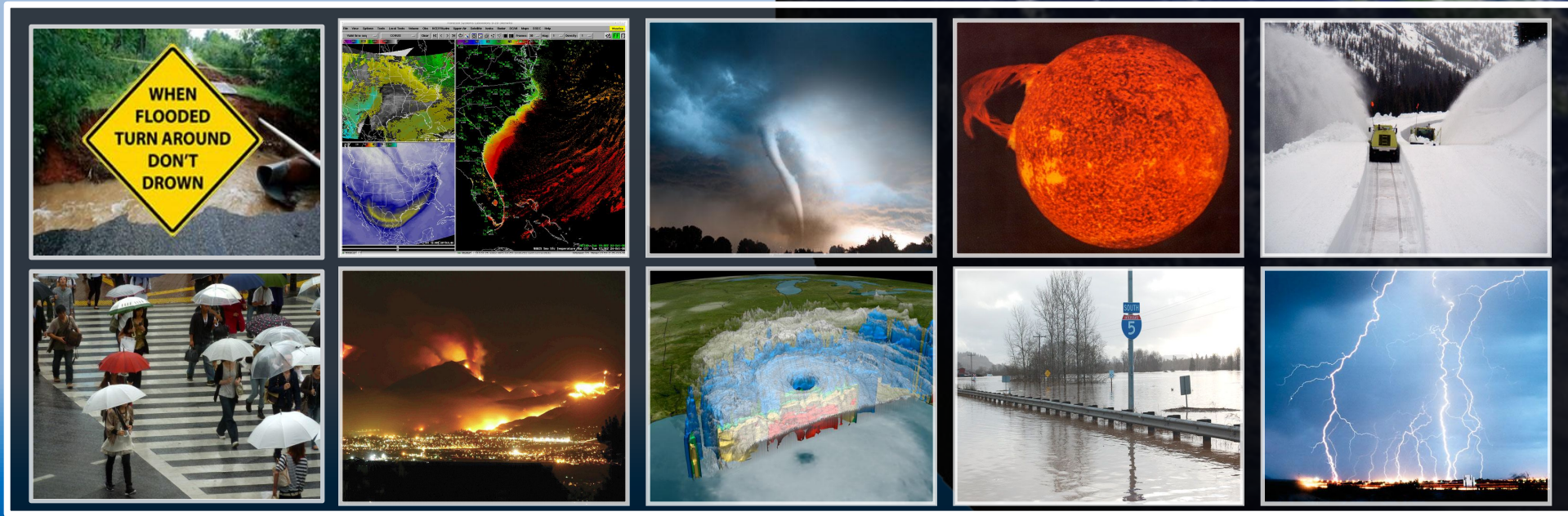


Cooperative Observer Program (COOP)

- On Apr 1, 2015, NWS' Office of Observations became single focal point for full lifecycle of COOP
  - The Office responds to requirements of National Service Programs
  - The Office recognizes the importance of maintaining the decades to century long climate record from COOP
  - The Office appreciates the efforts of the Regions and WFOs to maintain the COOP network
- Path forward for COOP
  - The Office is hiring a permanent Program Manager (PM)
  - New PM will conduct a complete review of COOP (FY17 AOP Milestone), from requirements to O&M
  - Amongst other aspects, the review will include ways to modernize systems with sustainable O&M
  - Will look to Regions and field to assist in the review of COOP and planning a way forward

NWS Climate Activities in Central Processing





NWS National Climate Services
May 10, 2016 · Silver Spring, MD

Central Processing Portfolio
Benefits and Scope

Central Processing Portfolio Benefits

Ensures uninterrupted flow of information from collection of observations to central guidance production to local applications of all essential weather and climate data products and continuity of public watches and warnings

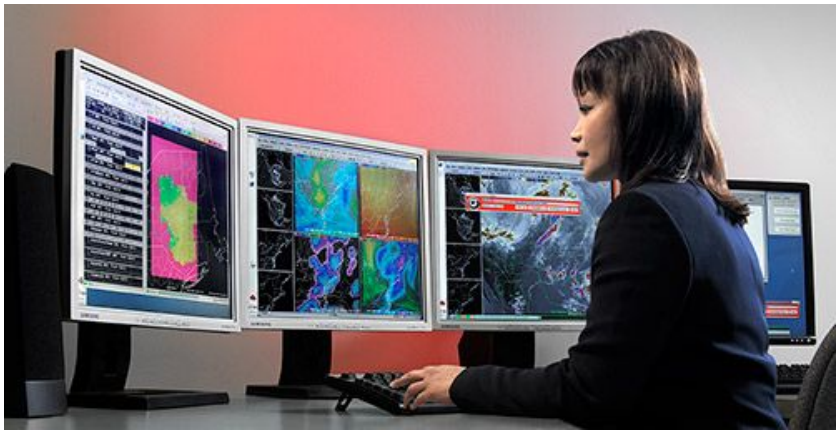
Central Processing Portfolio Scope

- Operate NWS' IT processing infrastructure
- Identify NWS' processing requirements and gaps
- Review NWS' processing system capabilities
- Seek solutions to fulfill NWS processing requirements
- Develop a strategy to maximize effectiveness while minimizing cost
- Coordinate NWS' processing system activities across NOAA
- Maintain a 24/7 help desk for all forecast systems

Central Processing Portfolio
Activities

Weather and Climate Operational Supercomputing System (WCOSS)

- 24x7 weather and climate forecasting capabilities
- Highly available, geographically separate primary and backup operational supercomputing systems
- Development supercomputing capability including resources for NOAA HFIP activity
- Associated storage resources, wide area network, and support services
- Numerical environmental prediction model development and testing



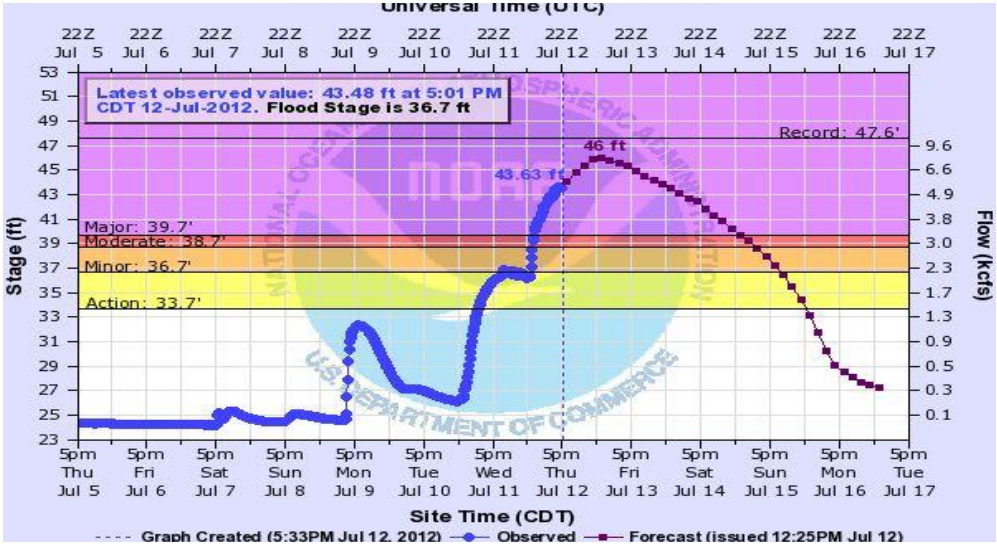
Advanced Weather Interactive Processing System (AWIPS)

- Integration and display of meteorological and hydrological data, satellite, and radar data at NWS field offices
- Acquires and processes data from sensors and local sources
- Computational and display functionality at operational sites
- Interactive communications system to interconnect NWS operational sites
- Initiates weather and flood warnings and forecasts in a rapid and highly reliable manner
- Communication interface to much of NOAA's real-time environmental data for internal and external users

Central Processing Portfolio
Activities

National Centers for Environmental Prediction (NCEP) Central Operations (NCO)

- 24x7 monitoring of NCEP Production suite
- 24x7 system maintenance and administration service
- Transition models into operations
- Quality assurance of observations and products
- Software development for data processing, display, interaction, and product generation
- Supports on-demand requirements including dispersion forecasts
- Deploys and supports centralized dissemination systems for the Integrated Dissemination Program



Hydrology Information Technology (IT)

- Advanced Hydrologic Prediction System (AHPS)
- Web-based suite of river-forecast products
- Expansion of advanced river forecast information to 4,011 locations throughout the United States by 2017
- Community Hydrologic Prediction System (CHPS)
- IT infrastructure enabling access to hydrologic models at all 13 River Forecast Centers

National Centers and Regional IT Infrastructure

- Maintenance of IT infrastructure and standards to enable National Centers and regional offices, including forecast offices to effectively work together
- Computing that occurs outside of AWIPS
- Local area networking
- IT Security
- Data center power and cooling

Central Processing Portfolio
AWIPS Climate Refresh Project

Current state

- AWIPS climate applications date back to early 1990s
- Applications are simply AWIPS-I re-hosted code in AWIPS-II

Development work in progress

- Re-work of climate applications to be consistent with AWIPS-II software architecture
  - Based on climate operational requirements document (ORD) developed in FY2015 by AWIPS Climate IWT through AWIPS Software Recommendation and Evaluation Committee (SREC)

Central Processing Portfolio
AWIPS Climate Refresh IWT

Current Membership of IWT

- Ed Mandel – Software Development Team Manager
- Ashley Kells – AWIPS Climate Refresh Project Lead
- Jim Zdrojweski – Climate Services Lead
- Xuewen Zhang – Developer (AWIPS Program Office)
- Pen Wang – Developer (AWIPS Program Office)
- Bryant Korzeniwski – National Centers for Environmental Information (NCEI)
- Peter Wu – NWS HQ
- William Gery - Central Region AWIPS Focal Point
- Matt Foster – Central Region AWIPS Focal Point
- Daniel Huckaby – WFO Forth Worth, TX (FWD)
- Michael Dangelo – WFO State College, PA (CTP)
- Virgil Middendorf – WFO Billings, MT (BYZ)

Central Processing Portfolio
AWIPS Climate Refresh IWT

First phase of development

- Scope of migration includes:
  - Daily Climate Product (CLI)
  - Climate Form 6 (CF6)
  - Monthly Climate Product (CLM)
  - Quarterly Climate Product (CLQ)
  - Seasonal Climate Product (CLS)
  - Annual Climate Product (CLA)
  - Record Event Report (RER)

- Concentrates on migrating legacy FORTRAN, C and executable SQL to Java
  - Fixes the approximate 60 outstanding AWIPS climate bugs
  - Adopts NCEI calculations to avoid rounding problems
  - Provides a CAVE climate perspective enabling framework for easier addition of functionality in future phases
  - Mixed case products

- Planning to test at WFOs FWD, CTP, and BYZ at a minimum before national release in 2017

Central Processing Portfolio
AWIPS Climate Refresh IWT

Future phase development under consideration

- Service backup capability
- Synchronization with Applied Climate Information System (ACIS) database
- Access to Cooperative Observer Program (COOP) data
- Ability to compare forecast values to historical averages for given time periods
- Ability to compare forecast values to recurrence intervals
- Reference to past weather events that were similar in impact to the forecast event
- New product formats (such as SHEF, CSV, JSON and xml)

Central Processing Portfolio
NOAA Big Data Project

Research through Data Alliances

Collaborators established in April 2015 as nucleus around which data marketplaces (Data Alliances) can form

https://data-alliance.noaa.gov/

amazon web services

Google Cloud Platform

IBM

Microsoft

OPEN CLOUD CONSORTIUM

Research Objective

- Explore value proposition and self-sustainability of business model by mimicking full market ecosystem via Data Alliances

What does success look like?

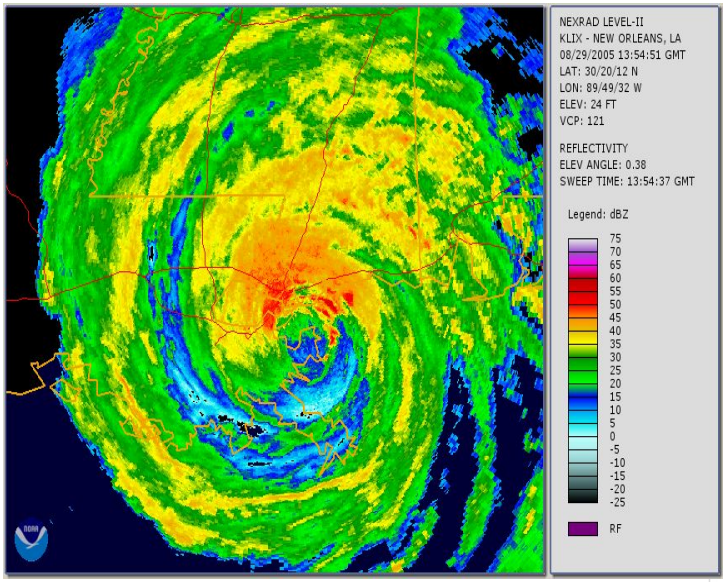
- Demonstrated sustainable use cases of a market ecosystem in one or more Data Alliance

Researching self-sustainable business model mimicking market ecosystem

Central Processing Portfolio

NOAA Big Data Project – Current Activities

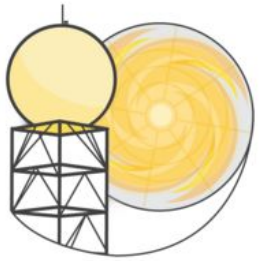
- NEXRAD Level II Data
  - Archive and real-time data freely available to public on Amazon Web Services
  - June 1991 - Present (270 TB compressed / 1 PB uncompressed)
  - 180 million files



NEXRAD on AWS

The Next Generation Weather Radar (NEXRAD) is a network of 160 high-resolution Doppler radar sites that detects precipitation and atmospheric movement and disseminates data in approximately 5 minute intervals from each site. NEXRAD enables severe storm prediction and is used by researchers and commercial enterprises to study and address the impact of weather across multiple sectors.

The real-time feed and full historical archive of original resolution (Level II) NEXRAD data, from June 1991 to present, is now freely available on Amazon S3 for anyone to use. This is the first time the full NEXRAD Level II archive has been accessible to the public on demand. Now anyone can use the data on-demand in the cloud without worrying about storage costs and download time.

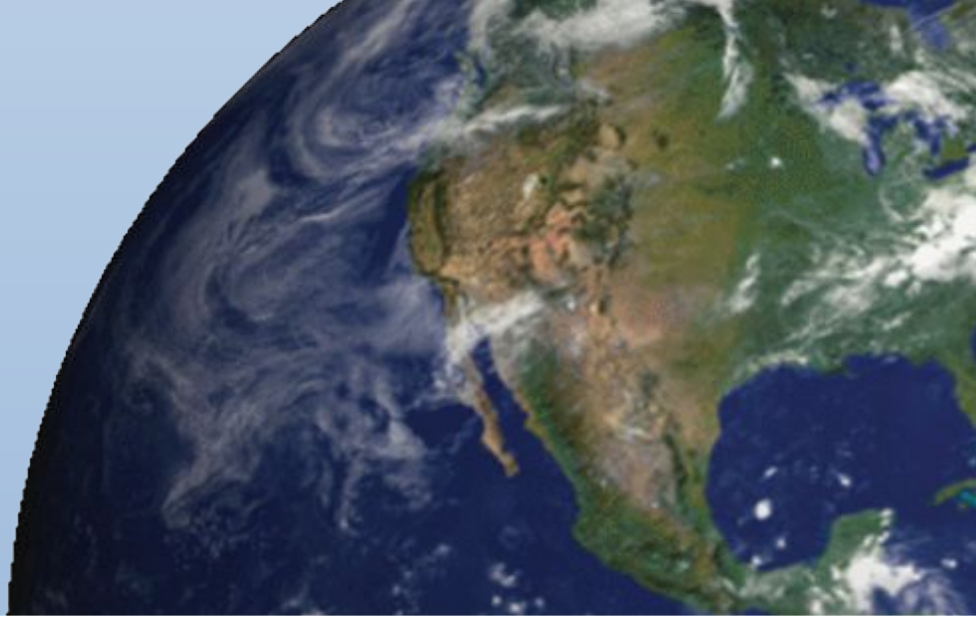


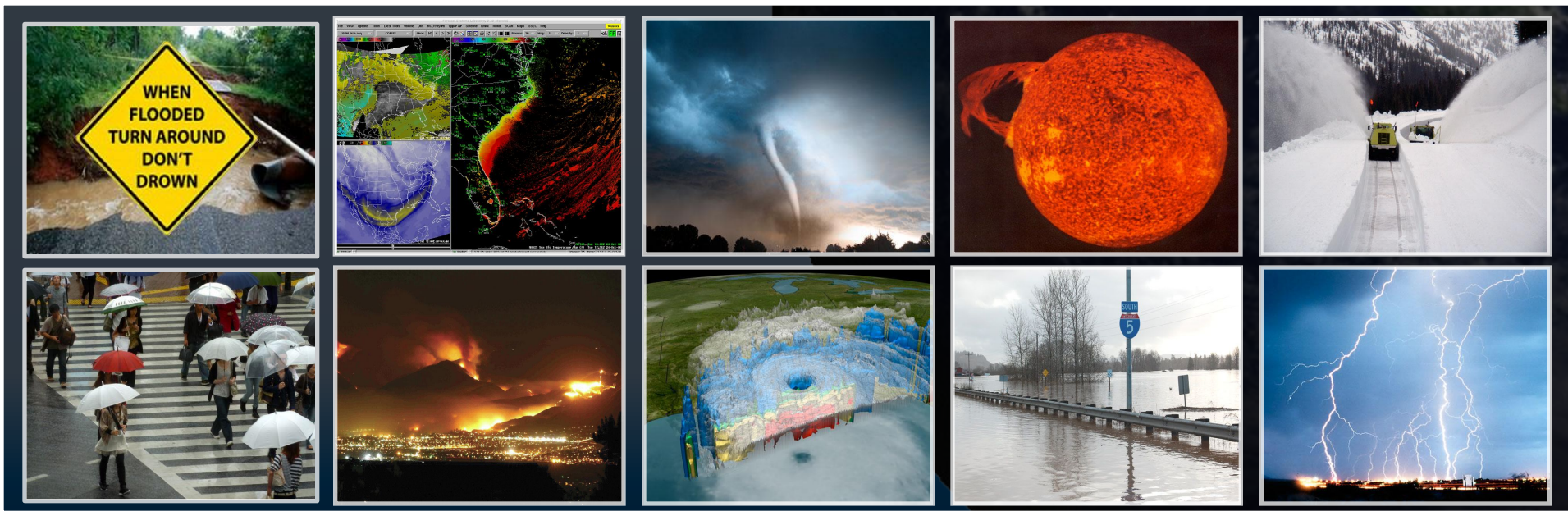
Project Updates

If you would like to show us what you can do with NEXRAD on AWS or would like to receive updates on the project, please fill out the form below.

Researching self-sustainable business model mimicking market ecosystem

NWS Climate Activities in Dissemination





NWS National Climate Services
May 10, 2016 · Silver Spring, MD

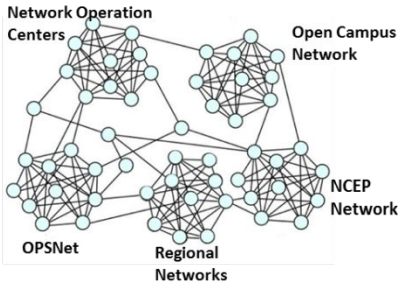
The Importance of NWS Dissemination

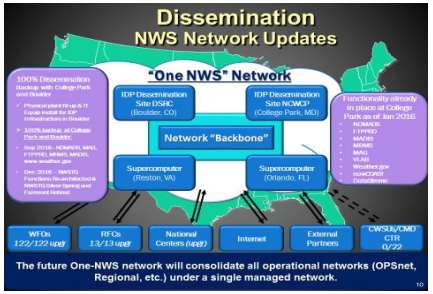
Integrated Dissemination Program (IDP) transforming NOAA's enterprise dissemination services including NWS' dissemination infrastructure to provide timely and reliable dissemination of weather, water, and climate data, forecasts and warnings supporting NWS' mission to protect life and property and enhance the national economy

Dissemination Portfolio
Benefits and Scope

Office of Dissemination: Thrust Areas

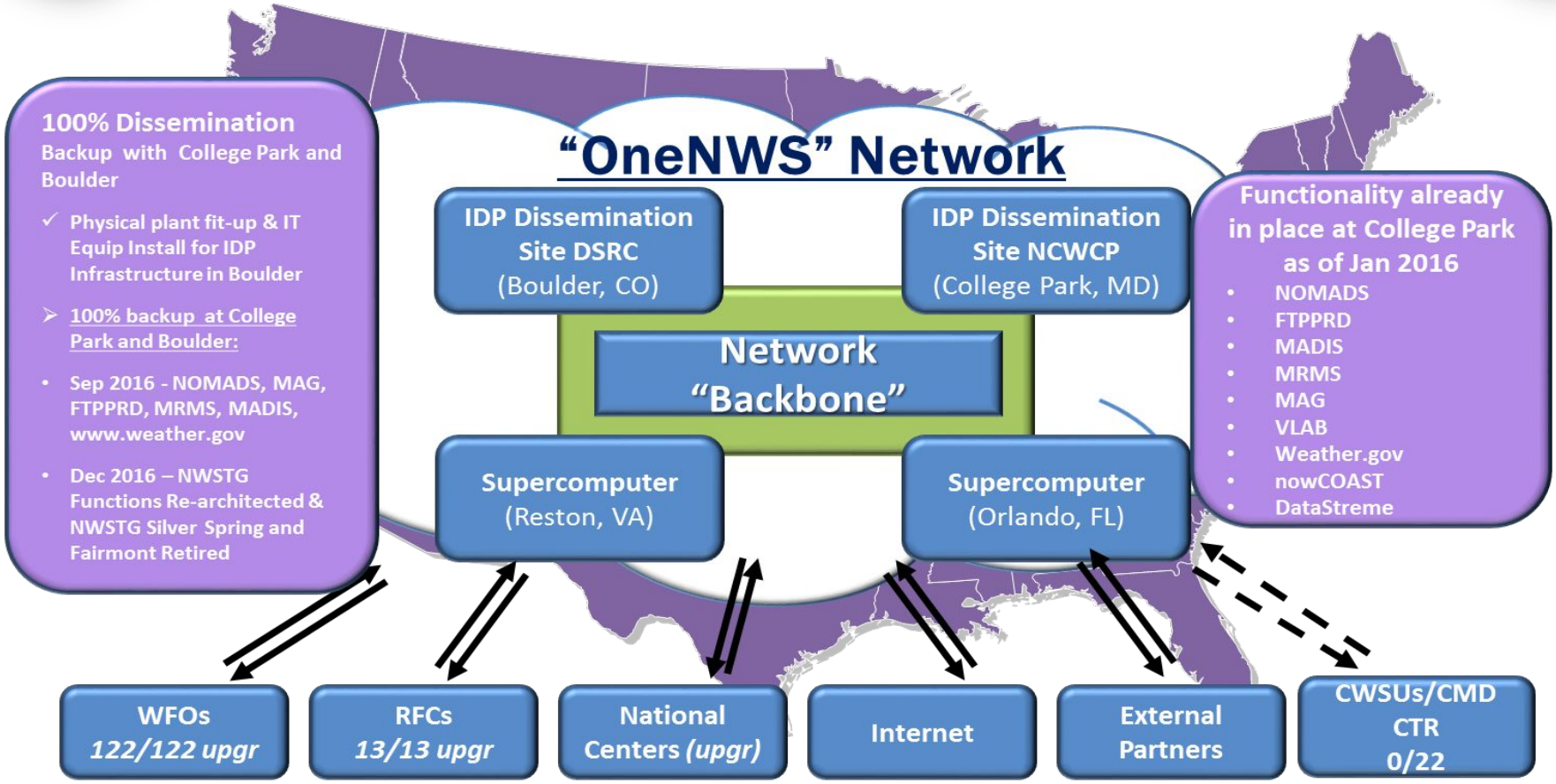
- **Service 1:** Dissemination IT Infrastructure & Virtualized Application Services
- **Service 2:** Terrestrial and Satellite Networking Services
- **Service 3:** Weather Information Distribution Services





3 multi-hour outages occurred Nov-Dec 2015 with legacy systems during severe weather versus 7 multi-day outages which occurred Nov-Dec 2013 during severe weather events

OneNWS Network
Long-Term Sustainable Solution



The future OneNWS Network will consolidate all operational networks (OPSnet, Regional, etc.) under a single managed network.

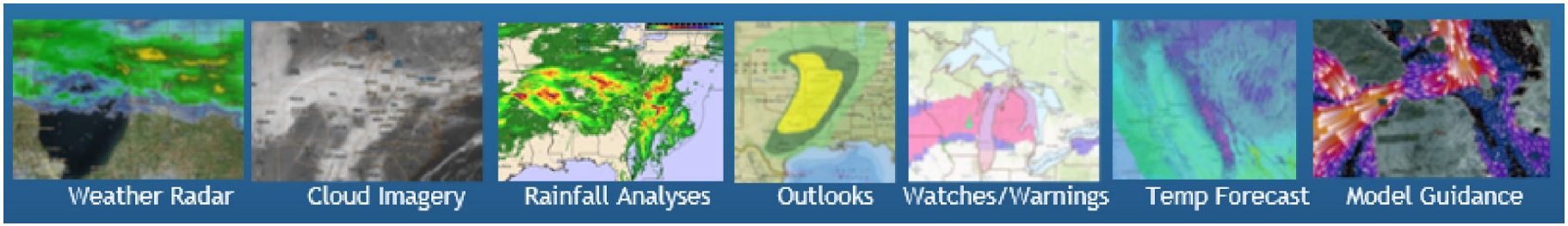
IDP Web and Geospatial Services

- **Standup and Maintain an Enterprise GIS Infrastructure**
  - Leveraging web services and GIS to disseminate NOAA and NWS critical data to forecasters, NOAA users, Federal partners (Federal Aviation Administration (FAA) and Federal Emergency Management Agency (FEMA)), International community and public
  - Implementing net-centric weather information dissemination capability to fulfill NWS' role for the Next Generation Air Traffic System (NextGen)
  - Onboarding current GIS capabilities onto infrastructure
  - Establishing common format framework for operating GIS data sets

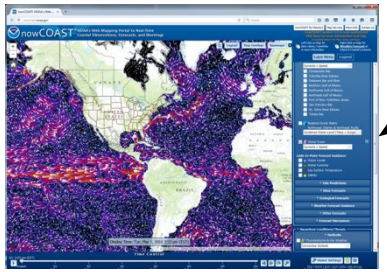
- **Establishing consistent metadata and a consolidated catalog for discovery and access of NOAA and NWS geospatial content**

NOAA's nowCOAST
nowcoast.noaa.gov

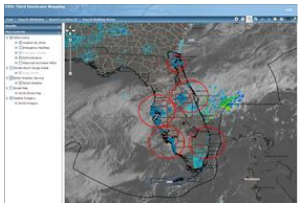
- **Provides users with situational awareness/coastal intelligence of the recent past, present, & future environmental conditions for the United States**
- **Integrates near-real-time data, analyses, warnings, forecasts, and model guidance from NOS, NWS, NESDIS, and other federal agencies**



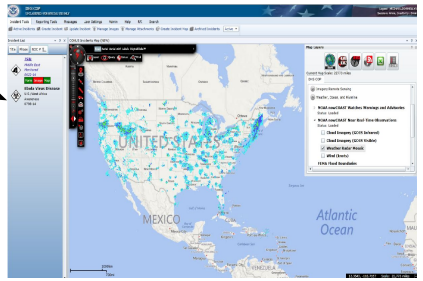
- **Provides these data & information via REST map services & OGC compliant WMS**



nowCOAST Map Viewer



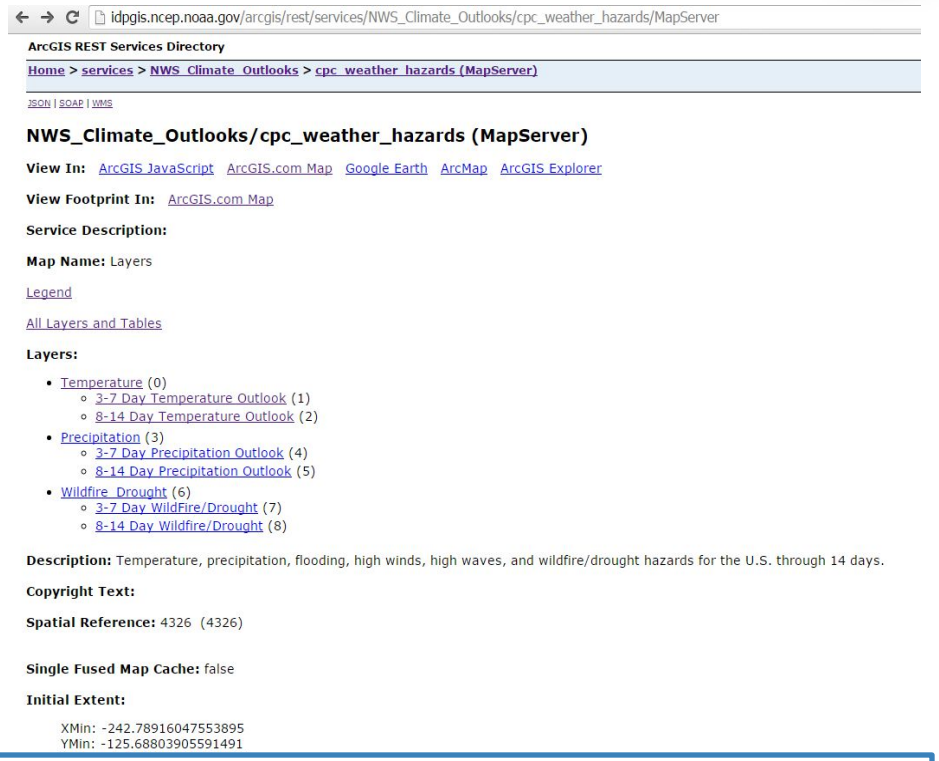
Fifth Third Bank Map Viewer



U.S. DHS COP Viewer

Viewer

IDP Climate Hazards via Web and Geospatial Services


idpgis.ncep.noaa.gov/arcgis/rest/services/NWS_Climate_Outlooks/cpc_weather_hazards/MapServer

ArcGIS REST Services Directory

Home > services > NWS_Climate_Outlooks > cpc_weather_hazards (MapServer)

JSON | SOAP | WMS

NWS_Climate_Outlooks/cpc_weather_hazards (MapServer)

View In: ArcGIS JavaScript ArcGIS.com Map Google Earth ArcMap ArcGIS Explorer

View Footprint In: ArcGIS.com Map

Service Description:

Map Name: Layers

Legend

All Layers and Tables

Layers:

- Temperature (0)
  - 3-7 Day Temperature Outlook (1)
  - 8-14 Day Temperature Outlook (2)
- Precipitation (3)
  - 3-7 Day Precipitation Outlook (4)
  - 8-14 Day Precipitation Outlook (5)
- Wildfire_Drought (6)
  - 3-7 Day WildFire/Drought (7)
  - 8-14 Day Wildfire/Drought (8)

Description: Temperature, precipitation, flooding, high winds, high waves, and wildfire/drought hazards for the U.S. through 14 days.

Copyright Text:

Spatial Reference: 4326 (4326)

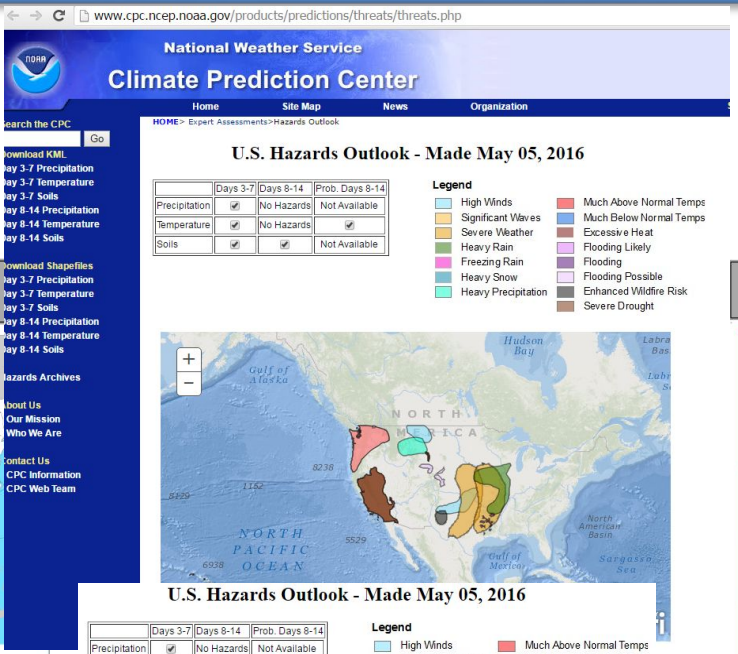
Single Fused Map Cache: false

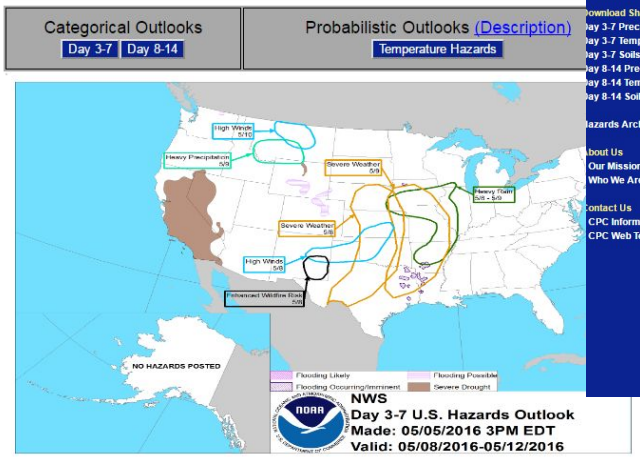
Initial Extent:

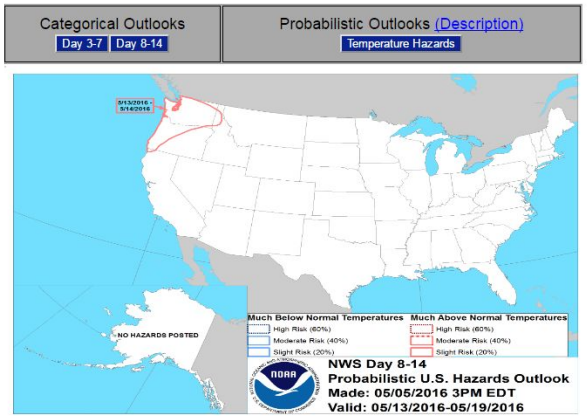
XMin: -242.78916047553895
YMin: -125.6880390559149

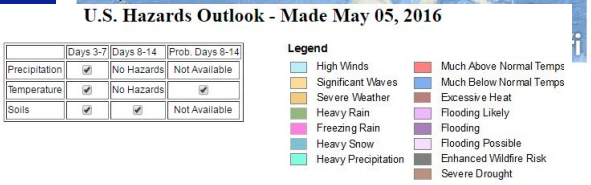
idpgis.ncep.noaa.gov
Provides the ability to gather the information you need and add the data to your own map.

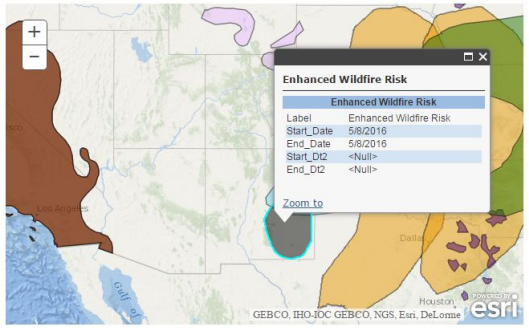
Climate Related
IDP Web and Geospatial Services





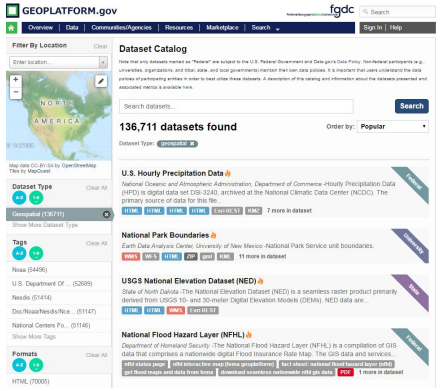




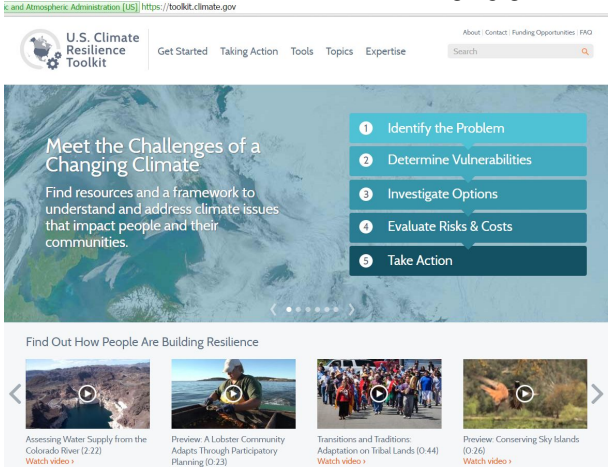


From a NOAA Perspective: Web and Geospatial Services

- The NOAA Geospatial Platform has groupings of services based on NOAA mission areas such as the Climate Group with multiple geospatial services registered



- Interest from the leads of the President's Climate Data Initiative to make connections between their activity and the NOAA Big Data Project
  - Both Amazon and Esri are partners in both efforts
  - The initial pilot dataset will be the Digital Elevation Model that underlies the NOAA Sea Level Rise Viewer. Testing is underway now



- Climate Resiliency Toolkit provides numerous geospatial datasets, services, apps, and other resources

Questions?